

AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF CLAIMS

1-14. (cancelled).

15. (currently amended) A drive axle assembly for use in a motor vehicle to transfer drive torque from a powertrain to a pair of wheels, comprising:

a housing defining a pump chamber, a gear chamber, and first and second clutch chambers;

a pinion shaft adapted to receive drive torque from the powertrain and having a shaft segment extending through said pump chamber and a pinion gear disposed in said gear chamber;

a drive unit assembly supported for rotation in said gear chamber and including a drive case having a ring gear meshed with said pinion gear;

a first output shaft supported for rotation relative to said housing and said drive unit assembly and adapted for connection to one of the wheels;

a second output shaft supported for rotation relative to said housing and said drive unit assembly and adapted for connection to the other of the wheels;

a first hydraulic coupling located within said first clutch chamber and including a first friction transfer clutch operably disposed between said drive case assembly and said first output shaft, a first actuator piston for engaging said first transfer friction clutch

in response to fluid pressure exerted thereon, and a first control valve for controlling the fluid pressure exerted on said first actuator piston;

a first seal mechanism for providing a fluid-tight seal between said first clutch chamber and said gear chamber;

a second hydraulic coupling located within said second clutch chamber and including a second friction transfer clutch operably disposed between said drive case assembly and said second output shaft, a second actuator piston for engaging said second friction transfer clutch in response to fluid pressure exerted thereon, and a second control valve for controlling the fluid pressure exerted on said second actuator piston;

a second seal mechanism for providing a fluid-tight seal between said second clutch chamber and said gear chamber;

a pump disposed in said pump chamber and driven by said pinion shaft for supplying pressurized fluid to said first and second control valves; and

a traction control system including speed sensors for detecting the rotary speed of at least two of said pinion shaft and said first and second output shafts, a first temperature sensor for detecting the fluid temperature in said first clutch chamber, a second temperature sensor for detecting the fluid temperature in said second clutch chamber, and a control unit receiving speed signals from said speed sensors and said temperature sensors and generating control signals in response thereto, said control signals delivered to said first and second control valves to independently vary the fluid pressure exerted on said first and second actuators pistons.

16. (original) The drive axle assembly of Claim 15 wherein said control unit includes logic for controlling actuation of said first control valve in response to predetermined relationships related to speed differences between said pinion shaft and said first output shaft.

17. (original) The drive axle assembly of Claim 16 wherein said logic is further operable to control actuation of said second control valve in response to predetermined relationships related to speed differences between said pinion shaft and said second output shaft.

18. (currently amended) The drive axle assembly of Claim 17 15 wherein said logic is further operable to control actuation of said first and second control valves in response to speed differences between said first and second output shafts.

19. (currently amended) The drive axle assembly of Claim 16 15 wherein said logic is further operable to compensate for changes in fluid viscosity based on the fluid temperature detected by a third temperature sensor.

20. (currently amended) The drive axle assembly of Claim 15 wherein said control unit is adapted to open said first control valve and vent fluid for releasing engagement of said first friction transfer clutch when the fluid temperature detected by said first temperature sensor exceeds a predetermined value.

21. (original) The drive axle assembly of Claim 15 further comprising an accumulator in fluid communication with an outlet of said pump and an inlet to each of said first and second control valves.

22. (previously presented) The drive axle assembly of Claim 15 wherein a first fluid is entrained in said gear chamber and a second fluid is entrained in said first and second clutch chambers and is in fluid communication with said pump.

23. (currently amended) A drive axle assembly for use in a motor vehicle to transfer drive torque from a powertrain to a pair of wheels, comprising:

a housing defining a pump chamber, a drive gear chamber, and first and second clutch chambers located on opposite sides of said drive gear chamber;

an input shaft adapted to receive drive torque from the powertrain and which extends through said pump chamber into said drive gear chamber;

a drive unit assembly rotatably supported in said drive gear chamber and which is driven by said input shaft;

a first output shaft adapted for connection to one of the wheels;

a second output shaft adapted for connection to the other of the wheels;

a first hydraulic coupling located within said first clutch chamber and including a first friction transfer clutch operably disposed between said drive unit assembly and said first output shaft, a first actuator piston for engaging said first friction transfer clutch in response to fluid pressure exerted thereon, and a first control valve for controlling the fluid pressure exerted on said first actuator piston;

a second hydraulic coupling located within said second clutch chamber and including a second friction transfer clutch operably disposed between said drive unit assembly and said second output shaft, a second actuator piston for engaging said second friction transfer clutch in response to fluid pressure exerted thereon, and a second control valve for controlling the fluid pressure exerted on said second actuator piston; and

a pump disposed in said pump chamber and which is driven by said input shaft for supplying pressurized fluid to said first and second control valves.

24. (currently amended) The drive axle assembly of Claim 23 further comprising a traction control system including speed sensors for detecting the rotary speed of at least two of said input shaft and said first and second output shafts, a first temperature sensor for detecting the fluid temperature in said first clutch chamber, a ~~second temperature sensor for detecting the fluid temperature in said second clutch chamber,~~ and a control unit receiving speed signals from said speed sensors and temperature sensor[[s]] and generating control signals in response thereto, said control signals delivered to said first and second control valves to independently vary the fluid pressure exerted on said first and second ~~actuators~~ pistons.

25. (previously presented) The drive axle assembly of Claim 24 wherein said control unit includes logic for controlling actuation of said first control valve in response to predetermined relationships related to speed differences between said input shaft and said first output shaft, and wherein said logic is further operable to control actuation of said second control valve in response to predetermined relationships related to speed differences between said input shaft and said second output shaft.

26. (previously presented) The drive axle assembly of Claim 24 wherein said logic is further operable to control actuation of said first and second control valves in response to speed differences between said first and second output shafts.

27. (currently amended) The drive axle assembly of Claim 24 wherein said control unit is adapted to open said first control valve and vent fluid for releasing engagement of said first ~~friction~~ transfer clutch when the fluid temperature detected by said ~~first~~ temperature sensor exceeds a predetermined value.

28. (previously presented) The drive axle assembly of Claim 23 further comprising an accumulator in fluid communication with an outlet of said pump and an inlet to each of said first and second control valves.

29. (currently amended) The drive axle assembly of Claim 23 wherein a first fluid is entrained in said ~~drive~~ gear chamber and a second fluid is entrained in said first and second clutch chambers and is in fluid communication with said pump.

30. (currently amended) A drive axle assembly for use in a motor vehicle to transfer drive torque from a powertrain to a pair of wheels, comprising:

a housing defining ~~first, second, third and fourth~~ a gear chamber and first and second clutch chambers;

a rotary input member adapted to receive drive torque from the powertrain and which extends through said ~~first chamber~~ housing into said second gear chamber;

a drive unit assembly rotatably supported in said second gear chamber and which is driven by said rotary input member;

a first rotary output member adapted for connection to one of the wheels;

a second rotary output member adapted for connection to the other of the wheels;

a first hydraulic coupling located within said ~~third~~ first clutch chamber and including a first friction transfer clutch operably disposed between said drive unit assembly and said first output member, a first actuator piston for engaging said first friction transfer clutch in response to fluid pressure exerted thereon, and a first control valve for controlling the fluid pressure exerted on said first actuator piston;

a first seal disposed between said ~~second and third chambers~~ gear chamber and said first clutch chamber;

a second hydraulic coupling located within said ~~fourth~~ second clutch chamber and including a second friction transfer clutch operably disposed between said drive unit assembly and said second output member, a second actuator piston for engaging said second friction transfer clutch in response to fluid pressure exerted thereon, and a

second control valve for controlling the fluid pressure exerted on said second actuator piston;

a second seal disposed between said ~~second and fourth chambers gear~~ chamber and said second clutch chamber;

a pump ~~disposed in said first chamber and driven by said input member for~~ supplying pressurized fluid to said first and second control valves; and

a traction control system including speed sensors for detecting the rotary speed of said input member and said first and second output members, and a control unit receiving speed signals from said speed sensors and generating control signals in response thereto, said control signals delivered to said first and second control valves to independently vary the fluid pressure exerted on said first and second ~~actuators~~ pistons.

31. (currently amended) The drive axle assembly of Claim 30 wherein said ~~third first and fourth second clutch~~ chambers are located on opposite sides of said ~~second gear~~ chamber, and wherein said drive ~~unit assembly~~ includes a drive case hub and having a ring gear driven by a pinion gear that is ~~driven~~ driven by ~~said shaft segment of~~ said input member.

32. (currently amended) The drive axle assembly of Claim 30 wherein said control unit includes logic for controlling actuation of said first control valve in response to predetermined relationships related to speed differences between said input member and said first output member, and wherein said logic is further operable to control actuation of said second control valve in response to predetermined relationships related to speed differences between said input member and said second output member.

33. (previously presented) The drive axle assembly of Claim 32 wherein said logic is further operable to control actuation of said first and second control valves in response to speed differences between said first and second output members.

34. (currently amended) The drive axle assembly of Claim 32 wherein said logic is further operable to compensate for changes in fluid viscosity based on ~~the a~~ fluid temperature detected by a ~~third~~ temperature sensor in one of said ~~third and fourth first and second clutch~~ chambers.

35. (currently amended) The drive axle assembly of Claim 34 wherein said control unit is adapted to open said first control valve and vent fluid for releasing engagement of said first ~~friction~~ transfer clutch when the fluid temperature detected by said temperature sensor exceeds a predetermined value.

36. (currently amended) The drive axle assembly of Claim 30 wherein a first fluid is entrained in said ~~second gear~~ chamber and a second fluid is entrained in said ~~third and fourth~~ first and second clutch chambers that is in fluid communication with said pump.

37. (new) The drive axle assembly of Claim 15 wherein said housing includes a gear housing, first and second support plates fixed to said gear housing to define said gear chamber therebetween, a first clutch housing fixed to said first support plate to define said first clutch chamber therebetween, and a second clutch housing fixed to said second support plate to define said second clutch chamber therebetween.

38. (new) The drive axle assembly of Claim 15 wherein said housing further includes a pump housing fixed to said gear housing to define said pump chamber therebetween.

39. (new) The drive axle assembly of Claim 23 wherein said housing includes a gear housing, first and second support plates fixed to said gear housing to define said gear chamber therebetween, a first clutch housing fixed to said first support plate to define said first clutch chamber therebetween, and a second clutch housing fixed to said second support plate to define said second clutch chamber therebetween.

40. (new) The drive axle assembly of Claim 39 when said housing further includes a pump housing fixed to said gear housing to define said pump chamber therebetween.

41. (new) The drive axle assembly of Claim 30 wherein said housing includes a gear housing, first and second support plates fixed to said gear housing to define said gear chamber therebetween, a first clutch housing fixed to said first support plate to define said first clutch chamber therebetween, and a second clutch housing fixed to said second support plate to define said second clutch chamber therebetween.

42. (new) The drive axle assembly of Claim 41 wherein said housing further includes a pump housing fixed to said gear housing to define a pump chamber within which said pump is operably disposed.